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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/765,717	01/26/2004	Shaz Qadeer	3382-66931	2565
26119 7590 02/06/2007 KLARQUIST SPARKMAN LLP 121 S.W. SALMON STREET SUITE 1600 PORTLAND, OR 97204			EXAMINER DENG, ANNA CHEN	
			ART UNIT 2191	PAPER NUMBER
SHORTENED STATUTORY PERIOD OF RESPONSE			MAIL DATE	
3 MONTHS			02/06/2007	
			DELIVERY MODE PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

# Office Action Summary

Application No.

10/765,717

Applicant(s)

QADEER ET AL.

Examiner

Anna Deng

Art Unit

2191

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/21/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

**DETAILED ACTION**

1. This action is in responses to application filed on 1/26/2004.
2. The preliminary amendment filed on 5/17/2004.
3. The Specification has been amended.
4. Claim 18 has been amended.
5. Claims 1-20 are pending and have been examined.

***Claim Rejections - 35 USC § 101***

6. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 1-12 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as being functional descriptive material.

Claims 1-12 set forth "a system for detecting a data race in a concurrent program comprising a program sequential module" that is computer programs claimed as computer listings per se, i.e., the descriptions or expressions of the programs, are not physical "things." They are neither computer components nor statutory processes, as they are not "acts" being performed. Such claimed computer programs do not define any structural and functional interrelationships between the computer program and other claimed elements of a computer which permit the computer program's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F. 3d at 1583-84, 32 USPQ2d at 1035 (see 1300 OG 142142 (November 22, 2005) (in particular, see Annex IV (a)).

8. Claims 13-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 13 set forth a method of analyzing a concurrent program for data races, the method creating a sequential program, recite "such that if the assertions are not met, the presence of

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a data race...is indicated." that is an alternate condition and result. Claim 18 is similar to claim 13, except that it set forth a computer-readable medium containing instructions. In determining whether the claim is for a "practical application," the focus is not on whether the steps taken to achieve a particular result are useful, tangible and concrete, but rather that the final result is "useful, tangible and concrete." The Federal Circuit further ruled that it is of little relevance whether a claim is directed to a machine or process for the purpose of a § 101 analysis. *AT&T Corp. v. Excel Commc'ns*, 172 F. 3d 1352, 1358, 50 USPQ2d 1447, 1451 (Fed. Cir. 1999).

As achieving the non-concrete results, claims 13-20 are not limited to a practical application, the claims are non-statutory.

9. Claims 18-20 set forth a computer-readable medium containing instructions. Applicant's Specification defines "The communication medium conveys information such as computer-executable instructions, audio/video or other media information, or other data in a modulated data signal..." (Specification, page 20, lines 18-24), reasonably interpreted to include signals encode with functional descriptive material. The Office's current position is that claims involving signals encoded with functional descriptive material do not fall within any of the categories of patentable subject matter set forth in 35 U.S.C. 101, and such claims are therefore ineligible for patent protection. See 1300 OG 142 (November 22, 2005) (in particular, see Annex IV (c)).

#### ***Claim Rejections - 35 USC § 112***

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements/steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. In independent claim 1, the omitted elements/steps are: how the assertions cause an error message to be produced. In independent claim 13, the omitted steps are: how the presence of a data race in the concurrent program for the target variable is indicated. In independent claim 18, the omitted

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elements/steps are: how the presence of an error in the concurrent program is indicated. Claims 2-12, 14-17, and 19-20 are rejected because they depend on claims 1, 13, or 18.

12. Claims 5, 13, and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 13 and 18, lines 6 recite, "such that if the assertions are not met, the presence of a data race...is indicated". The claims have the alternative condition and results that cause the claims are being indefinite.

In claim 5, lines 5, recites "the analyzed variable", there is insufficient antecedent basis for this limitation in the claim. In the interest of compact prosecution, this limitation is subsequently interpreted as --the target variable--.

At the end of claim 5, recites "the variable", as the claim contains a "target variable" and a "global access variable", it is not clear the limitation refers to which variable. The limitation is ambiguity. As best understood by examiner, "the variable" refers to "target variable".

#### ***Claim Rejections - 35 USC § 102***

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

14. Claims 1-20 are rejected under 35 U.S.C. 102 (b) as being anticipated by Christiaens, US 2002/0120428.A1 (hereinafter Christiaens).

#### **Per Claim 1:**

Christiaens discloses:

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- A system for detecting a data race in a concurrent program (paragraph 0018, lines 1-6), the system comprising:
- a program sequentializer module configured to accept a concurrent program as input (Figs. 17a-17b, paragraph 0246-0247, 0255-0261, the sequentializer module consists of elements in 17a or 17b), and create as output a sequential program having assertions (paragraph 0255, "the actual race detection is carried. For this, 20 bytecodes, for instance, are instrumented which read or write to an object. Each time such a byte code is executed, it is checked whether it is a global object...If a global object is being dealt with, the extra data structures can be accessed and it can be verified, ...whether this instruction represents a data race. If so, this is flagged to the user (emphasis added)");
- wherein the assertions cause an error message to be produced when the concurrent program contains a data race (Fig. 1, 111 and 109, paragraph 0102, lines 23-27, paragraph 0106).

**Per Claim 2:**

Christiaens discloses:

- The system of claim 1, further comprising a sequential program analyzer module which analyzes the sequential program and produces error messages if assertions are not met and wherein the assertions are created to be checked by the sequential program analyzer ("a report of potential data races", paragraph 0025).

**Per Claim 3:**

Christiaens discloses:

- The system of claim 1, wherein the sequential program utilizes a single runtime stack (Fig. 13, stack 1501, paragraph 0192) and the program sequentializer module is further configured

to add data structures (Fig. 4, instrumentation 404, a thread information structure 410, paragraphs 0169-0172) to the received code, the added data structures at least comprising:

- a multiset of thread pointers which comprises pointers to threads which have been created but have not yet been scheduled on the runtime stack (Fig. 4, pointers 405-406, 408, paragraphs 0114-0115, and 0117); and
- a global boolean exception variable which, when set, causes the sequential program to remove from the runtime stack the currently-executing thread (Figs. 4-5 and 13, TID field, paragraphs 0116, and 0183-0189).

**Per Claim 4:**

Christiaens discloses:

- The system of claim 3, wherein: the multiset of thread pointers is limited to a maximum number of pointers; and the added data structures further comprise a global multiset size variable, which indicates the maximum number of pointers (the length of the translation table 611, Fig. 6, paragraphs 0136-137) .

**Per Claim 5:**

Christiaes discloses:

- The system of claim 3, wherein: the program sequentializer module is further configured to receive an indication of a target variable which will be analyzed for data races (Fig. 13, global set 1508, paragraphs 0019, 0183); and
- the added data structures further comprise a global access variable which indicates, for the analyzed variable, the current type of access being requested of the variable (paragraphs 0036, and 0038).

**Per Claim 6:**

Christiaens discloses:

- The system of claim 5, wherein the program sequentializer module is further configured to insert instrumentation into the received code (Fig. 4, instrumentation 404, thread information structure 410), the instrumentation at least comprising:
  - a scheduling function which selects a thread pointer from the multiset and schedules the thread indicated by the pointer on the runtime stack (synchronization operation, paragraph 0171);
  - an exception macro which sets the global boolean exception variable and causes an executing thread to be removed from the runtime stack ( $S_{tot}$ , paragraph 0194-0195);
  - a read-checking function, which checks to see that the global access variable does not indicate that the target variable is being written to and then sets the global access variable to indicate that the target variable is being read from (Fig. 14, 1609, 1010, 'read information structure', paragraph 0205); and
  - a write-checking function, which checks to see that the global access variable does not indicate that the target variable is being read from or written to and then sets the global access variable to indicate that the target variable is being written to (Fig. 14, 1610, 1618, 'write information structure' paragraph 0206).

**Per Claim 7:**

Christiaens discloses:



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- The system of claim 6, wherein the read-checking and write-checking functions contain assertions about the global access variable which can be checked by the sequential program analyzer module (Fig. 14, 1611 and 1618, paragraphs 0207-0218).

**Per Claim 8:**

Christiaens discloses:

- The system of claim 6, wherein the instrumentation is inserted so that it will execute nondeterministically in the sequential program (Fig. 4, instrumentation 404, paragraphs 0170-174).

**Per Claim 9:**

Christiaens discloses:

- The system of claim 1, wherein the sequential program output by the sequentializer module is in the form of source code (sequential execution order of code, paragraphs 1056, 0162).

**Per Claim 10:**

Christiaens discloses:

- The system of claim 1, wherein the sequential program output by the sequentializer module is in the form of an abstract syntax tree or a control-flow graph (Fig. 7, sequential execution order of events in one thread,  $T_1$ , paragraph 0162).

**Per Claim 11:**

Christiaens discloses:

- The system of claim 1, wherein the concurrent program received by the sequential analyzer is in the form of source code (Figs 8-10,  $T_1$  and  $T_2$ , paragraphs 0163-0166).

**Per Claim 12:**

Christiaens discloses:

- The system of claim 1, wherein the concurrent program received by the sequential analyzer is in the form of an abstract syntax tree or control-flow graph (Figs. 8-10, and 13, paragraphs 0174-0175).

**Per Claims 13-17:**

These are method version of the claimed system discussed above (claims 1-8), wherein all claimed limitations also have been addressed and/or covered in cited areas as set forth above. Thus accordingly, these claims are also anticipated by Christiaens.

**Per Claims 18-20:**

These are computer-readable medium version of the claimed method discussed above (claims 13-15), wherein all claimed limitations also have been addressed and/or covered in cited areas as set forth above. Thus accordingly, these claims are also anticipated by Christiaens.

***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anna Deng whose telephone number is 571-272-5989. The examiner can normally be reached on Monday to Friday 9:30 AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wei Zhen can be reached at 571 -272-3708. The fax phone number for the organization where this application or proceeding is assigned is 703-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC)  
at 866-217-9197 (toll-free).

Anna Deng

*A.D.*

January 24, 2007

*May Stulman*  
*Primary Examiner*  
*2-1-2007*